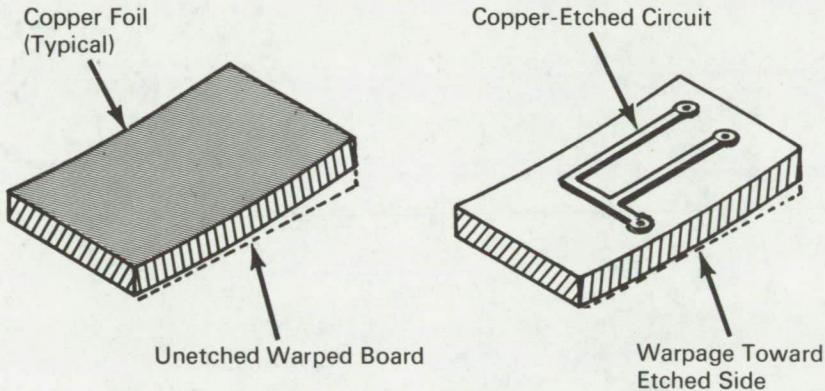


NASA TECH BRIEF



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Warpage Eliminated in Copper-Clad Microwave Circuit Laminates



The problem:

To prevent stresses, inherent in copper-clad microwave circuit laminates, that cause warpage when a circuit is etched on one side of the board. This warpage causes various problems in manufacturing processes and decreases reliability of microwave components.

The solution:

Treat the laminated circuit boards cryogenically. Prior to etching, the stresses may be eliminated to prevent warpage; after etching, they may be eliminated to reduce warpage.

How it's done:

The temperature required to stress-relieve a board depends upon the composition of the plastic which makes up the board. A copper-clad, fiberglass/styrene

copolymer board (Rexolite 2200) employed for study, required -80°C to prevent warpage during etching and to eliminate warpage resulting from etching. The process used for the board tested follows:

- (1) Prior to etching, the flat boards are slowly cooled to -80°C , maintained at that temperature for one to two hours, and slowly returned to room temperature.
- (2) Boards that have not been treated, as described above, and have warped during manufacture, are first heated to $+100^{\circ}\text{C}$. This is to allow clamping between two sheets of aluminum with minimum stress. After the boards are clamped flat, they are cooled to -80°C , maintained at that temperature for one to two hours, and returned to room temperature.
- (3) Etched boards, if warped, may also be treated as described in step (2) above.
- (4) The boards that were treated in this manner remained flat and were processed and assembled without difficulty.

(continued overleaf)

Notes:

1. Further details of the method are contained in:
*Stress Relief of Copper-Clad Microwave Circuit
Laminates to Reduce and Prevent Warpage*, IBM
Report No. 67-U60-0021, 25 May 1967.

2. This report is available from:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: B67-10454

Patent status:

Inquiries about obtaining rights for the commercial
use of this invention may be made to NASA, Code
GP, Washington, D.C. 20546.

Source: W. L. Boone, Jr.
of IBM
under contract to
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